SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-41

Name: Lake Alvin **County**: Lincoln
Legal Description: T100N- R49W-Sec. 33, 34
Location from nearest town: 3 miles east of Harrisburg, SD.

Dates of present survey: June 23-25, 2008 (netting)
Dates of last survey: June 25-27, 2007 (netting); June 10, 2007 (electrofishing)

Primary Game and Forage Species	Other Species
Largemouth Bass	Yellow Perch
Black Crappie	Black Bullhead
White Crappie	Common Carp
Bluegill	White Sucker
Channel Catfish	Green Sunfish
Walleye	Northern Pike
	Fathead Minnow

PHYSICAL DATA

Surface area: 105 acres **Watershed area:** 24,564 acres
Maximum depth: 26 feet **Mean depth:** 9 feet
Volume: 930 acre feet **Shoreline length:** 4.3 miles
Contour map available: Yes **Date prepared:** 1997
Lake elevation observed during the survey: Full
Beneficial use classification: (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

Introduction

Lake Alvin is an artificial impoundment formed by the construction of a dam across the lower end of Nine Mile Creek. It was named for Alvin Dempewolf, the only World War soldier from Harrisburg who died overseas. The construction of the dam was completed in August 1954 and the lake completely filled in 1957. The concrete spillway for the dam was completely replaced in 1994.

Ownership of Lake and Adjacent Lakeshore Properties

Most of the land inundated by and surrounding Lake Alvin is owned and managed by the South Dakota Department of Game, Fish and Parks (GFP). The Parks Division of GFP manages a State Recreation Area surrounding the southeast, east, and northeast corners of the lake as well as a Lake Access Area on the northwest corner of the lake. The remainder of the shoreline is privately owned.

Fishing Access

The Lake Alvin Recreation Area has a single lane boat ramp with a dock, public toilet, and parking lot as well as several areas accessible to shore fishing. On the southeast corner of the dam there is a handicapped accessible fishing dock and several shorefishing areas. The Lake Access Area on the northwest corner of the lake has a public toilet and a narrow boat ramp with a dock suitable for small boats. There is plenty of shoreline to fish; however, the water is shallow in this area. The entire lake has been designated as a no-wake zone to protect the shoreline from erosion. At no time can boats exceed 5 mph or produce a visible wake.

Field Observations of Water Quality and Aquatic Vegetation

The Secchi depth measurement during the survey was 1 m (39 in) near the east boat ramp. The water was much more turbid in the west end. Small beds of sago pondweed (*Potamogeton pectinatus*) and floating leaf pondweed (*Potamogeton natans*) were scattered along the south shore. Sparse stands of common cattail (*Typha spp.*) are found at the west end of the lake.

BIOLOGICAL DATA

Methods:

Lake Alvin was sampled on June 23-25, 2008 with nine overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh (¾ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. Sampling locations are displayed in Figure 3.

Results and Discussion:

Trap Net Catch

Black bullhead (41.8%), bluegill (27.0%), and black crappie (18.7%) were the most common species sampled in the trap nets (Table 1). Five additional species were also sampled.

Table 1. Total catch from nine overnight trap net sets at Lake Alvin, Lincoln County, June 23-25, 2008.

Species	Number	Percent	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	364	41.8	40.4	±35.3	43.4	3	0	87
Bluegill	235	27.0	26.1	±13.1	95.0	88	0	99
Black Crappie	163	18.7	18.1	±7.2	44.5	13	0	102
White Sucker	64	7.4	7.1	±4.4	5.1	100	92	85
Channel Catfish	39	4.5	4.3	±3.8	1.8	29	0	89
O. S. Sunfish	2	0.2	0.2	±0.2	1.8	--	--	--
White Crappie	2	0.2	0.2	±0.3	21.4	--	--	--
Northern Pike	1	0.1	0.1	±0.1	0.1	--	--	--

* 10 years (1998-2007)

Black/White Crappie

Management objective: Maintain a crappie fishery with a trap-net CPUE of at least 20 and PSD of at least 40.

Black crappie trap-net CPUE in 2008 was similar to 2004 and lower than 2005-2007 (Table 2). Only once in the last ten years have the management objectives for abundance and PSD been attained at the same time. Young crappie growth is similar to statewide and small impoundments means (Table 3), but slows by age 3. The 2006 year class dominated this year's catch (Table 2 and 3; Figure 1) and the presence of fish from five consecutive year classes indicates consistent natural recruitment. Crappie condition (Mean Wr) in 2008 was near the 10-year mean (Table 2).

In 2007, 2,752 black crappies were transferred from Lake Alvin to other lakes and another 2,563 were moved in 2008. This was done in an attempt to increase the growth and overall size of the remaining fish. Fathead minnows were also stocked in 2008 to supplement the lake's forage base and contribute to increasing growth.

The white crappie population was decimated by a fish kill in 2004 and has not recovered at this time (Table 4).

Table 2. Black crappie trap-net CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 1999-2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean*
CPUE	65.5	61.6	63.9	68.0	28.8	19.7	32.3	32.3	32.5	18.1	44.5
PSD	19	21	14	25	49	29	10	34	3	13	21
RSD-P	0	0	0	0	0	0	0	7	0	0	1
Mean Wr	106	111	106	112	93	90	95	110	102	102	104

* 10 years (1998-2007)

Table 3. Average back-calculated lengths (mm) for each age class of black crappie in Lake Alvin, Lincoln County, 2008.

			Back-calculation Age							
Year Class	Age	N	1	2	3	4	5	6	7	8
2007	1	22	83							
2006	2	61	82	148						
2005	3	58	87	155	185					
2004	4	4	77	158	186	198				
2003	5	18	92	136	147	169	187			
All Classes		**163**	**84**	**149**	**172**	**184**	**187**			
Statewide Mean			83	147	195	229	249			
Region III Mean			95	167	219	253	274			
SLI* Mean			78	134	180	209	226			

*Small Lakes and Impoundments (<150 acres)

Table 4. White crappie trap-net CPUE, PSD, RSD-P and mean relative weight (Wr) for Lake Alvin, Lincoln County, 1999-2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean*
CPUE	44.3	35.5	17.1	13.1	74.8	0.9	0.1	0.8	0.3	0.2	21.4
PSD	17	25	15	17	49	67	--	--	--	--	29
RSD-P	1	2	3	2	0	0	--	--	--	--	1
Mean Wr	87	100	83	108	88	78	--	--	--	--	93

*10 years (1998-2007)

Bluegill

Management objective: Maintain a bluegill fishery with a trap-net CPUE of at least 20 and RSD-18 of at least 20.

Bluegill trap net CPUE was the lowest since 1999 (Table 5). The 2004 year class was the most abundant, but fish from five year classes between 2001 through 2006 were also present (Table 6). Growth after age-2 is slower than the statewide, regional and small impoundment means (Table 6).

In the last ten years, the management objective for RSD-18 has not been achieved. Combined with the growth information above, this suggests bluegill growth in Lake Alvin is density dependent. In 2007, 1,267 bluegills were transferred to other lakes in an attempt to increase the growth of the remaining fish. In 2008, stock density indices and relative weight have increased slightly with lower bluegill abundance so the removal effort may be having some effect.

Table 5. Bluegill trap-net CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 1999-2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean*
CPUE	11.7	26.5	48.3	115.3	229.3	172.1	186.5	47.5	87.9	26.1	95.0
PSD	26	34	26	11	26	47	60	51	37	88	38
RSD-18	5	2	1	0	1	5	0	5	3	8	5
RSD-P	3	0	0	0	0	0	0	0	0	0	1
Mean Wr	96	105	86	119	94	88	95	92	91	99	97

*10 years (1998-2007)

Table 6. Average back-calculated lengths (mm) for each age class of bluegills in Lake Alvin, Lincoln County, 2008.

			Back-calculation Age							
Year Class	Age	N	1	2	3	4	5	6	7	8
2006	2	5	48	120						
2005	3	44	52	118	150					
2004	4	168	55	115	138	158				
2003	5	9	43	88	120	148	170			
2001	7	8	55	112	140	154	167	177	187	
All Classes		**234**	**50**	**111**	**137**	**153**	**169**	**177**	**187**	
Statewide Mean			55	103	141	166				
Region III Mean			60	116	157	180				
SLI* Mean			53	101	138	163				

*Small Lakes and Impoundments (<150 acres)

All Fish Species

Black bullhead CPUE has been declining since 2006 and is below the level considered a nuisance (Table 7). Channel catfish CPUE increased after adult fish from Lake Oahe were stocked in 2004 and 2005. The abundance of most other species remains within previously observed ranges.

Table 7. Trap-net (TN) CPUE for all fish species sampled in Lake Alvin, Lincoln County, 1999-2008.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
GOS	--	--	0.1	--	--	--	0.1	--	0.1	--
COC	0.5	0.2	0.1	0.2	0.1	0.1	0.5	--	--	--
WHS	3.2	9.5	9.4	4.8	2.5	4.3	3.8	2.5	4.5	7.1
BLB	0.6	3.2	0.1	2.1	8.5	16.5	12.1	247.7	140.9	40.4
CCF	0.2	0.6	1.1	2.7	0.9	1.8	0.9	5.8	3.1	4.3
NOP	--	0.1	0.2	0.3	0.1	--	0.1	--	0.1	0.1
GSF	--	--	0.1	--	0.2	0.2	0.2	0.3	0.5	--
HYB	0.1	--	--	--	3.8	--	--	0.1	0.1	--
OSF	0.9	0.8	6.9	2.8	1.4	0.9	--	--	4.0	0.2
BLG	11.7	26.5	48.3	115.3	229.3	172.1	186.5	47.5	87.9	26.1
SMB	--	--	--	0.2	--	--	--	--	--	--
LMB	--	--	--	--	--	--	--	0.1	--	--
WHC	44.3	35.5	17.1	13.1	74.8	0.9	0.1	0.8	0.3	0.2
BLC	65.5	61.6	63.9	68.0	28.8	19.7	32.3	32.3	32.5	18.1
YEP	1.4	1.9	5.0	3.4	2.9	1.7	0.4	0.2	0.2	--
WAE	--	0.1	0.1	--	--	--	--	--	--	--

GOS (Golden Shiner), COC (Common Carp), WHS (White Sucker), BLB (Black Bullhead), CCF (Channel Catfish), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), OSF (Orange-spotted Sunfish), BLG (Bluegill), LMB (Largemouth Bass), SMB (Smallmouth Bass), WHC (White Crappie), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

MANAGEMENT RECOMMENDATIONS

1. Funding has been approved to build a silt retention dam on Nine Mile Creek above Lake Alvin. This dam will prevent sediment and other pollutants from entering the lake, resulting in better water quality and aquatic habitat. Construction is tentatively scheduled to begin in 2010.

2. A project to install a water level control structure is under consideration. The structure will allow occasional lowing of water levels to dry and compact loose sediment in the upper portion of the lake, to establish terrestrial and wetland vegetation for short-term habitat improvement and to allow nutrients trapped in the sediments to be released and used for increased fish production.

3. Significant progress has been made to secure and fence GFP boundaries around the lake. When completed, there will be little or no access for cattle to the shoreline. This should improve water quality by decreasing nutrient and sediment inputs.

4. Suspend efforts to improve crappie and bluegill growth and population size structure through fish removals and supplemental forage stocking. These activities may affect our ability to successfully evaluate the effects of the silt retention dam and water level manipulation.

5. Evaluate the 2008 efforts to improve crappie and bluegill growth by stocking supplemental forage and fish removals.

6. Plan and implement a monitoring program designed to evaluate the effects of the silt retention dam and water level manipulation on water quality, aquatic vegetation, sediment depths, invertebrate populations, fish populations, and recreational use.

7. Stock walleye when surplus fish are available to increase angler use and diversify fishing opportunity.

Table 8. Stocking record for Lake Alvin, Lincoln County, 1991-2008.

Year	Number	Species	Size
1991	525,000	Fathead Minnow	Adult
	3,000	Walleye	Lrg. Fingerling
1992	30,000	Black Crappie	Fingerling
	12,000	Channel Catfish	Fingerling
	3,212	Walleye	Lrg. Fingerling
	29,500	Yellow Perch	Fingerling
1993	3,355	Walleye	Lrg. Fingerling
1994	9,036	Black Crappie	Lrg. Fingerling
1996	1,203	Black Crappie	Adult
1997	9,000	Largemouth Bass	Fingerling
2002	195	Largemouth Bass	Adult
2003	201	Largemouth Bass	Adult
2004	358	Channel Catfish	Adult
	220	Largemouth Bass	Adult
2005	460	Channel Catfish	Adult
2007	430	Walleye	Adult
2008	684,610	Fathead Minnow	Adult

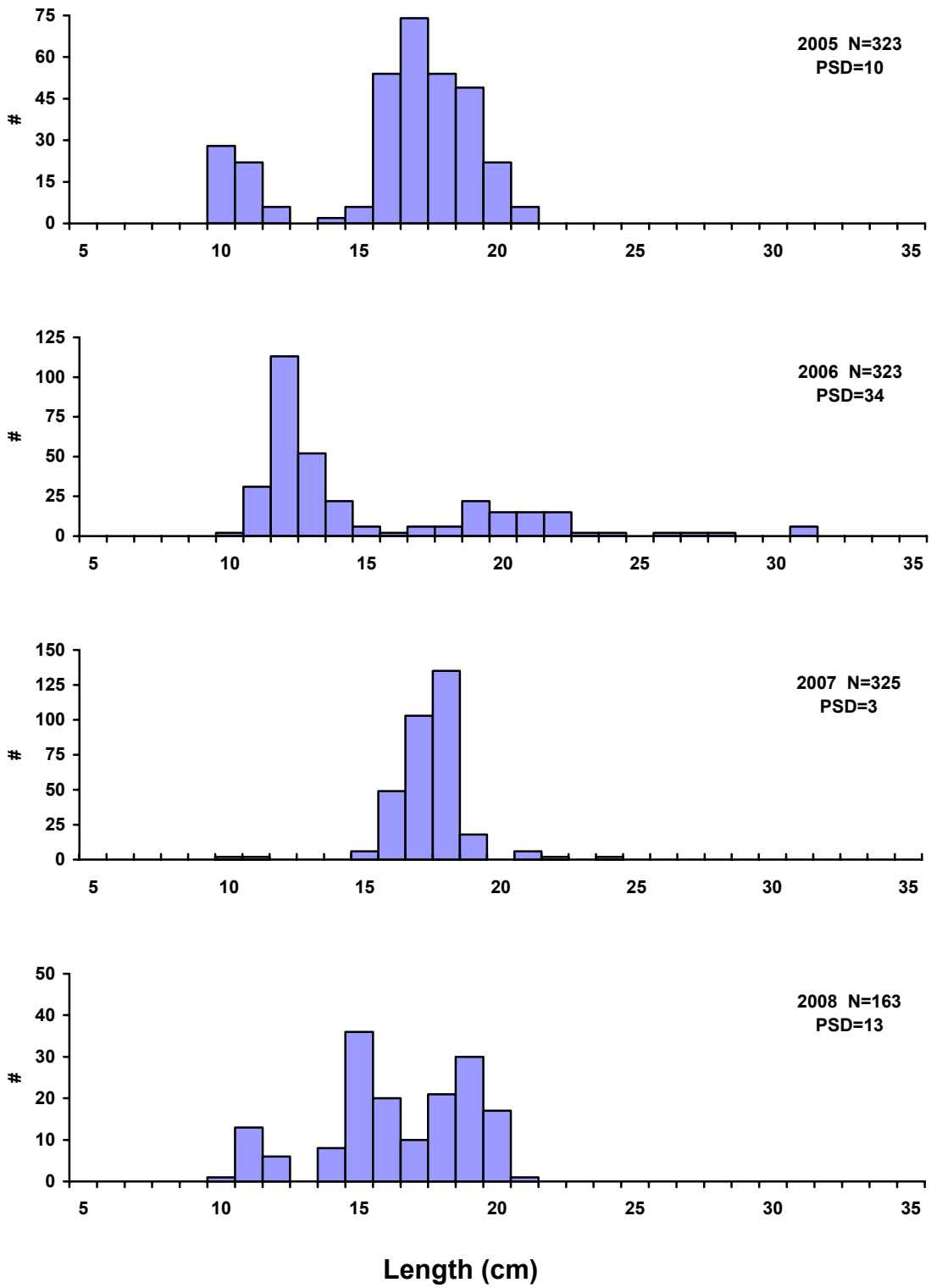

Figure 1. Length-frequency histograms for black crappies sampled with trap nets in Lake Alvin, Lincoln County, 2005-2008. Length frequency of the total catch was extrapolated from a sample of 100 measured fish.

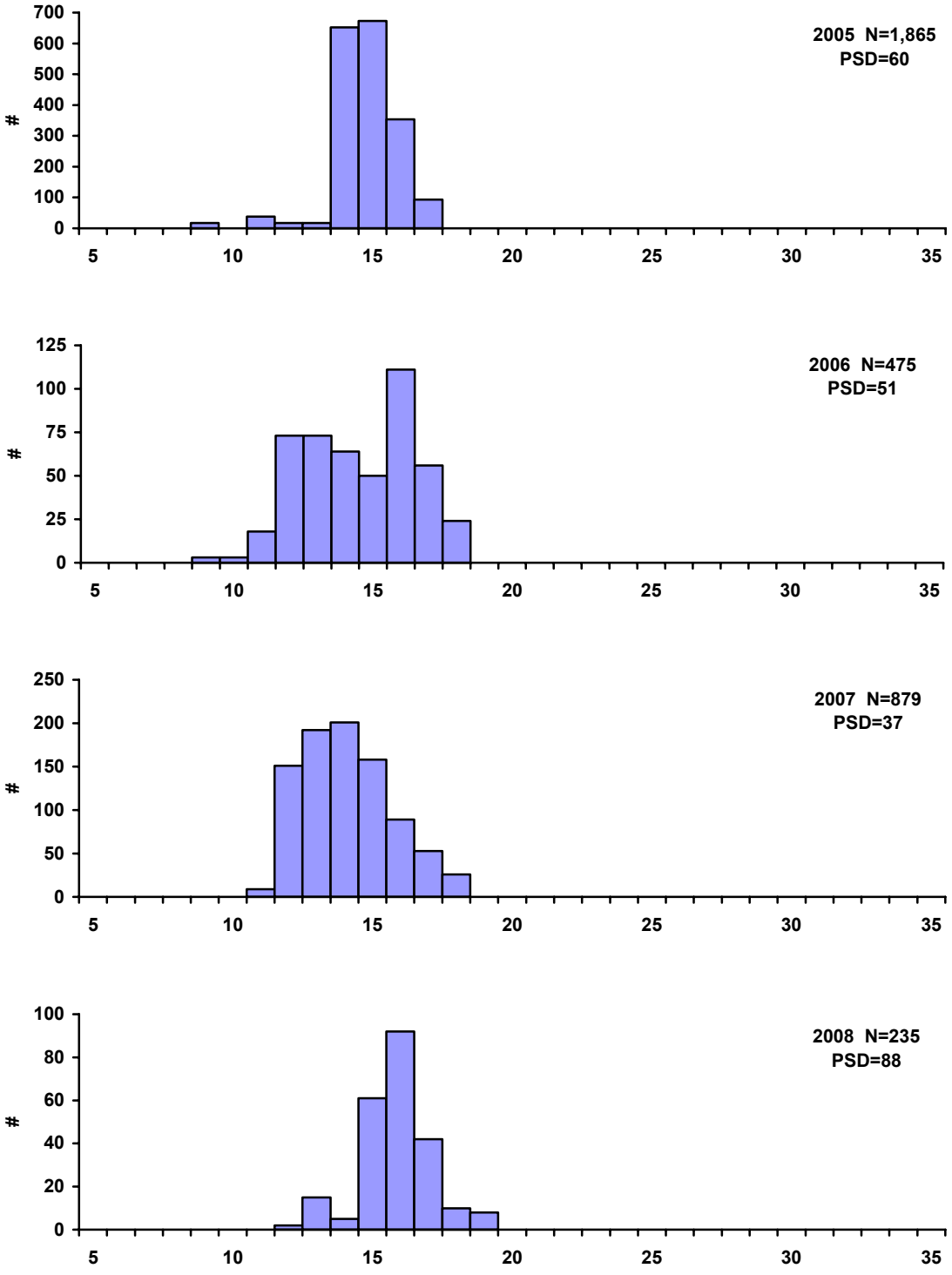

Figure 2. Length-frequency histograms for bluegill sampled with trap nets in Lake Alvin, Lincoln County, 2005-2008. Length frequency of the total catch was extrapolated from a sample of 100 measured fish.

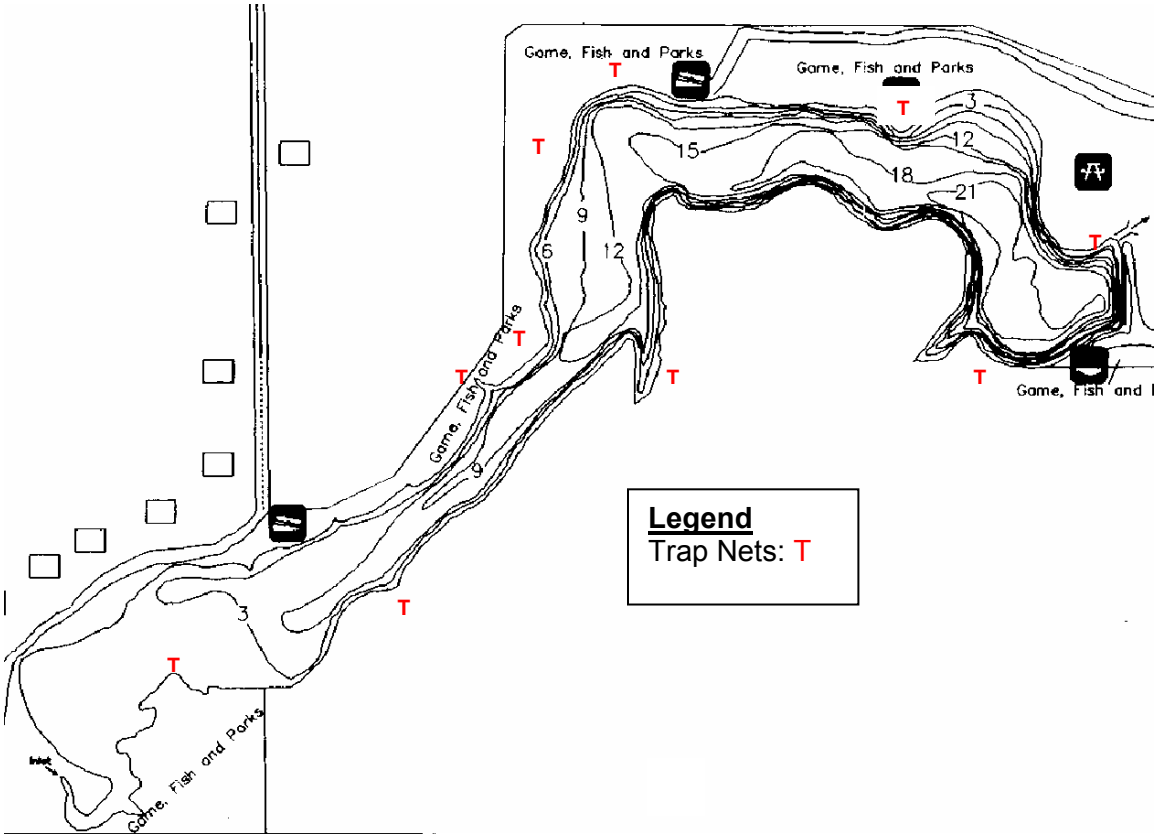

Figure 3. Sampling locations on Lake Alvin, Lincoln County, 2008.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.